ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

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DCXXXV.—CACAO DISEASE IN TRINIDAD.

(*With Plate.*)

The cultivation of cacao is an important industry in many British colonies. This is especially the case in Trinidad, where the crop has recently suffered (as is sooner or later the fate of all cultural industries) from disease.

The facts are detailed in the following correspondence. The preliminary steps in their investigation reflect great credit on the Superintendent of the Royal Botanic Gardens. Their complete discussion required the technical assistance of Kew.

GOVERNOR OF TRINIDAD TO ROYAL GARDENS, KEW.

Government House, Trinidad,
December 20, 1898.

SIR,

THE Superintendent of the Trinidad Botanic Gardens will forward to your department by the present mail specimens of cacao pods attacked by a fungus which is reported to be doing serious damage to the cacao in certain districts of this island, and which, unless checked, may, it is feared, prove disastrous to that industry.

It is hardly necessary for me to assure you that this Government will be very thankful for such early assistance and advice in the matter as it may be in your power to afford.

I have, etc.,
(Signed) HUBERT E. H. JERNINGHAM,
Governor.

Sir W. T. Thiselton-Dyer,
Royal Gardens, Kew.

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SUPERINTENDENT, ROYAL BOTANIC GARDENS, TRINIDAD, TO ROYAL GARDENS, KEW.

Botanical Department, Trinidad,
SIR, December 17, 1898.

I FORWARD you by this mail a set of specimens of a disease affecting growing cacao pods, which is said in some districts to cause a loss of as much as 50 per cent. of the crop.

2. The question has been up some time, and I have had several sets of specimens for examination. Up to December 8, however, I had never been able to reproduce the disease in healthy pods by inoculation.

3. On receipt of diseased pods from Mr. T. H. Warner, Warden of Tacarigua, a Government officer of high standing, I commenced a microscopic examination and found a fungus permeating the specimens, causing in one instance the upper half of the pod to decay, and in two instances the lower part of the pod. Placed in a damp chamber, the whole pod rapidly became covered with the fungus, and in an ordinary atmosphere the same took place less rapidly.

4. With a view of ascertaining whether the fungus was parasitic or saprophytic, I made a microscopic examination and procured spores, which I placed in a small slit in the skin of healthy pods. This resulted in the rotting away of the infected pods in seven days' time and the reproduction of an abundant crop of the same spores on all sides of the pods. One hundred per cent. of artificially-infected pods rotted away.

5. I send some portions preserved in formalin solution, some parts dried and some fresh-packed in dry charcoal. If more specimens are required I shall be glad to take instructions as to preparation for the journey.

6. It appears to me that it would be well to suggest the application of "Bordeaux Mixture," and the picking and burning of all infected pods, dressings to take place after the collection of the rotten pods.

7. The disease appears to me to be essentially an outside disease, and obtains entrance through wounds or punctures from any cause. It may be possible that insect-punctures would enable the spores to gain access to the pods. It is certain that a cut or incision will.

Yours faithfully,
The Director, (Signed) J. H. HART.
Royal Gardens, Kew.

SUPERINTENDENT, ROYAL BOTANIC GARDENS, TRINIDAD, TO ROYAL GARDENS, KEW.

Botanical Department, Trinidad,
SIR, January 5, 1899.

WITH regard to cacao pod disease, I now submit further information collected since last mail.

2. I visited the infected estate, and found the disease rampant in low hollows and damp places, especially where heaps of broken shells had been allowed to rot upon the ground. On the ridges

and in dry places little disease appears, except where pods have been opened under the trees and the shells have been allowed to lie and rot.

3. After the pods are destroyed by the fungus—which has lance-shaped spores—it is soon taken possession of by numerous saprophytic fungi, which practically eradicate all trace of the original destroyer.

4. If the fungus is new, I suggest it should be named after Mr. Bain, who first called attention to it.

5. Mr. Bain reports that, by clearing out all diseased pods and destroying at once all shells of the opened, he has checked the disease on his estate.

6. I have again reproduced the disease in numerous healthy pods.

7. So far as can be judged by Mr. Carruthers's report, the cacao in Ceylon has the pods affected by a similar organism. The description of the trees and the age given show that cacao in Ceylon has a much lower vitality than in Trinidad, and consequently is more liable to disease.

8. The pod-disease is apparently no new thing. Planters say it has been noted for years, but not so bad as this year.

Yours faithfully,
(Signed) J. H. HART.

The Director,
Royal Gardens, Kew.

The living material forwarded by Mr. Hart reached Kew in excellent condition for examination, exhibiting every phase of the disease, and growing vigorously when placed under favourable conditions. Ample spirit material was also sent.

Microscopic examination revealed the presence of two distinct fungous parasites; one being the well known *Phytophthora omnivora*, De Bary, a species closely allied to *Phytophthora infestans*, De Bary, the cause of the potato disease; the other a *Nectria*, which proves to be new to science, and will be known as *Nectria Bainii*, the name suggested by Mr. Hart, in compliment to Mr. Bain, who first called attention to the disease.

The *Phytophthora* was present on all the pods sent, and may be considered as the cause of the present epidemic in Trinidad. The same or a closely allied species appears to be the cause of the cacao-pod disease in Ceylon.

The *Nectria* appeared on two pods, and this again possesses many points in common with the *Nectria*, which has caused such destruction to cacao trees in Ceylon by attacking the bark of the trunk and branches, as described by Mr. J. B. Carruthers. At present no mention is made of other than the pod-disease in Trinidad, but the fact of a parasitic *Nectria* being present necessitates the prompt execution of measures calculated to prevent the parasite from extending its ravages.

Phytophthora omnivora, De Bary.

This fungus, as indicated by its specific name, is not fastidious in its choice of a victim, and has been recorded as attacking various species of plants belonging to the following genera : *Acer*, *Alonsoa*, *Abies*, *Cleome*, *Clarkia*, *Cereus*, *Epilobium*, *Fagopyrum*, *Fagus*, *Gilia*, *Larix*, *Lepidium*, *Melocactus*, *Œnothera*, *Picea*, *Pinus*, *Solanum*, *Sempervivum*, *Salpiglossis*.

If the fungus is confined to the fruit of the cacao tree it is obvious that infection each season must necessarily be derived from some outside source, the spores for this purpose being in all probability often produced on diseased fruit or "shells" lying on the ground under the trees; nevertheless being able to live on such a variety of host-plants, infection of a plantation for the first time might very possibly be attributed to wind-borne spores produced on some other kind of host-plant. This may appear to be poor consolation. However it is well to be in possession of all known facts and possibilities in connection with the subject under consideration. The life-history of the fungus is well known, having been carefully studied by De Bary, Hartig, and others.

The conidial form of fruit appears as a very delicate white mould on the surface of the part attacked. The conidia or reproductive bodies are ovate or egg-shaped, being attached at the broad end to a very slender stalk, which shrivels and liberates the conidium when mature. This condition of the fungus flourishes for a few weeks during the period of active growth of the host-plant; and as the conidia are produced in immense numbers and in quick succession, and are dispersed by wind, insects, or rain, being washed from diseased part of a tree to healthy parts, it can readily be understood why the pest spreads so quickly when once established. Conidia that happen to alight on young pods germinate at once, penetrate the tissues, and quickly produce a new centre of disease which furnishes more conidia in due time.

During the period occupied in the production of the external form of fruit described above, the mycelium of the fungus spreads rapidly in the substance of the pod and gives origin to a second form of fruit imbedded in the tissue of the pod. These reproductive bodies, known as resting spores remain for some months in a passive condition, and are eventually liberated by the decay of the pod : when they germinate, the bodies produced on germination being conveyed by wind to the young pods, germinate in their turn, enter the tissue, and in a few days' time produce the conidial form of the fungus on the surface of the pod.

Preventive Measures.—If it is ascertained that the fungus is not harboured by other plants growing in the neighbourhood of the plantation, but is confined to the cacao trees, then prevention becomes an easy matter. It depends on having every diseased fruit collected and burned ; for the only possible cause of infection in the first instance must arise from the germination of resting-spores developed in diseased pods, and so long as these are allowed to remain on the ground under the trees the disease will continue to spread. But the fungus may also attack other wild plants, and thus become firmly established and defy extermination.

The following measures should be taken to combat the disease :—

i. Spray with Bordeaux mixture, commencing when the pods are quite young, and continue at intervals of ten days.

A dilute solution should first be used until its effect on the fruit and foliage is ascertained. A small quantity of dried blood should be dissolved and added to the mixture ; its adhesive property is much increased, and fewer sprayings are required.

ii. Remove all diseased fruit from the tree if practicable, otherwise a continuous supply of conidia will be furnished until the fruit decays. Do not allow diseased fruit or "shells" to remain on the ground. All such should be collected and burned.

iii. Endeavour to ascertain, by careful examination, whether the fungus may not be also parasitic on other hosts ; it very frequently attacks seedlings, and would be recognised by the wilting of the attacked parts, and by the delicate white mould-like conidial form of reproduction.

Nectria Bainii, Massee.

This parasite causes semicircular dark blotches to appear on the pods, the diseased portion becoming soft and watery. At a later stage the blotches become covered with a loosely interwoven layer of yellowish-rust coloured or orange mycelium which is studded over with the minute bright red perithecia or fruiting organs of the fungus.

The perithecia are often preceded by a small snow-white *Fusarium*-like mould, which, from analogy with other species, may be a conidial condition of the *Nectria*. But the connection has not however been proved by cultures.

This parasite may possibly be quite rare ; but great care should be taken to arrest any attempt on the part of the fungus to attack the trunk of the cacao tree, for as already stated the destructive canker disease of the cacao in Ceylon is caused by a *Nectria*.

Nectria Bainii, Massee. *Perithecia* gregaria, mycelio maculiformi flavo-ferrugineo vel aurantiaco insidentia, sphæroidea, rubra, lanosa, demum supra calvescentia, 300–350 μ diam. *Asci* cylindraceo-clavati, breviter pedicellati, octospori, 80–90 × 7–9 μ. *Sporæ* distichæ, oblongo-ellipticæ, utrinque subacutæ, 1–septatæ, 10–12 × 5 μ, hyalinæ. Geo. Massee.

Fig. 1. *Phytophthora omnivora* ; Section of a portion of a cacao fruit, showing the conidial form of reproduction of the fungus on the surface, × 300.

2. A conidium of the same germinating, × 300.

3. Oospores of the same produced in the diseased tissue of a cacao fruit, × 400.

4. Pustule of *Nectria* bursting through the skin of a cacao fruit, and producing the conidial form of reproduction, × 40.

5. Portion of the conidial form of fruit, × 400.

6. Free conidia of same, × 400.

7. *Nectria Bainii*, Surface view of sporophores seated on a byssoid stroma, × 50.

8. Three perithecia in different stages of development, showing the byssoid covering of the exterior.

9. Asci, × 400.

10. Germinating spores of same, × 400.

11. Asci of a saprophytic species of *Nectria* appearing after the fruit is dead, × 400.

12. Spore of same showing the granular protoplasm; the epispore is smooth, × 1000.

DCXXXVI.—COCCID PESTS ON SUGAR CANE.

In the Kew Report for 1877, p. 39, reference is made to Coccids or scale insects, that had ravaged the cane fields of Bourbon and Mauritius, known locally as "le pou à poche blanche." Mr. Robert McLachlan, F.R.S., pointed out that this was a collective name, and probably included several species. The most prominent at the time was believed to be *Icerya sacchari*, Guérin-Méneville.

Somewhat similar insects also made their appearance on sugar cane in Queensland. One of these was afterwards identified as *Icerya Purchasi*, Maskell, fully described (with a coloured plate) in *Kew Bulletin* (1889, pp. 191–216).

In 1887, correspondence relating to the attacks of Coccids on forest trees in the island of Rodrigues was referred to Kew with specimens by the Secretary of State for the Colonies. Mr. McLachlan had little doubt that these insects were identical with those that "had long been known to occasion great damage in the neighbouring islands of Bourbon and Mauritius."

The following further information has been received respecting the Mauritius insects :—

MR. T. D. A. COCKERELL TO ROYAL GARDENS, KEW.

Agricultural Experiment Station,
Mesilla Park, New Mexico,
July 15, 1898.

DEAR SIR,

THE note on the moth-borers of the sugar cane in *Kew Bulletin*, 1898, p. 102, suggests that you may like to have the latest information on the Coccid pest of sugar-canes in Mauritius, if this information has not already reached you from elsewhere.

In 1864, M. E. Icery, in a memoir presented to the Chamber of Agriculture in Mauritius, gave an account of a Coccid which had done much injury to sugar-cane in that island. He called it "le pou à poche blanche."

Guérin-Méneville, in the *Rev. et Mag. Zool.*, 1868, discussed the sugar-cane Coccids of Mauritius and Réunion, and concluded that under the name "pou à poche blanche" had been confused three Coccids, which he called *Coccus sacchari*, *Gasteralphes Iceryi*, and *Lecanium Guerinii*, and also an aleurodid, *Aleurodes Bergii*. The first species was described and named by Guérin-Méneville himself; the other three were described by Signoret.

Gasteralphes Iceryi is now known as *Pulvinaria gasteralpha* (Icery) ; and *Coccus sacchari* is *Icerya seychellarum* (Westwood). Of these two, the former is still imperfectly known ; but the latter is well known, and has been found in Madeira, Seychelles, Rodrigues, Mauritius, Hong Kong, Canton, Amoy, and Formosa. It occurs in China on rose and *Podocarpus*.

Without citing the rather copious bibliography, it will suffice to say that since the early seventies it has been held that the real culprit in Mauritius was the *Icerya sacchari*.

The late Mr. W. M. Maskell, in Trans. New Zealand Institute for 1896, p. 320, records that he received some of the sugar-cane coccid from Mauritius, through Mr. Lounsbury of Cape Town ; and it was not an *Icerya*, but to his surprise it turned out to be *Dactylopius sacchari*, Ckll., which I had described from Trinidad (B. W. I.) in 1895. It was understood that it occurred with *Icerya sacchari*, "and the two species are confounded by the residents under the name of '*pou blanc*'"; Mr. Maskell still supposed that the latter was the principal offender.

But in a letter dated August 29, 1897, Mr. Maskell wrote me :— "Note in my paper of 1896 your *Dactylopius sacchari* from Mauritius. In a letter just received from that island, I am told that *Icerya sacchari* never does any harm whatsoever to sugar-cane, and that it is, in fact, never seen on that plant, even accidentally ; therefore we have all been wrong about it for the last five and twenty years."

There can be little doubt that the *Dactylopius sacchari* is of eastern origin, though it happened to be first described from Trinidad.

Yours very truly,

(Signed) THEO. D. A. COCKERELL.

DCXXXVII.—MOSS FLORA OF THE ROYAL GARDENS, KEW.

In the *Kew Bulletin* for 1897 (p. 115) it was pointed out that of the half a square mile occupied by the Royal Gardens and some adjacent pieces of Royal property, above a third or "some hundred acres is little disturbed by any kind of cultivation, and it has certainly remained so for at least a century and a half. Some portions may never possibly have been subjected to cultivation at all. It is not surprising, therefore, that in the background of horticultural treatment there still subsists a wild fauna and flora of no inconsiderable dimensions. These, as opportunity offers, it is proposed to work out and catalogue from time to time."

The flowering plants were catalogued by Mr. Nicholson in the *Journal of Botany* for 1875 ; the fungi by Mr. Massee in the *Kew Bulletin* (*l.c.*, pp. 115–167). Kew is indebted to Mr. Ernest S. Salmon for a further instalment towards a complete enumeration of the flora in the list of mosses now published, which, with the introductory remarks below, is from his pen.

One hundred and six species of mosses and seven varieties were collected in the Royal Botanic Gardens, Kew, in 1898, unless otherwise stated. The strip of ground between the Gardens and the Thames has been added so as to make the area the same as that worked by Mr. George Nicholson for his "Wild Flora of Kew Gardens."

To anyone unacquainted with the wild parts of Kew Gardens it may seem incautious to consider as indigenous any of the mosses now found growing within these limits. But it is only with regard to those of a very few places, such as the Rockery, for which some of the stones were originally brought from Cheddar and Bath and may possibly have brought mosses attached to them, that a probability of introduction exists. In many places in the Gardens, *e.g.*, the boundary ditch and bank running the length of the Old Deer Park, the Queen's Cottage Grounds, parts of the Palace grounds, etc., the nature of the surface makes it quite safe to consider the species growing there as indigenous. The inclusion of the river-bank in the area has led to the addition of several interesting aquatic mosses, and, without doubt, all these are quite wild.

A few common species are absent from the list, while, on the other hand, several rare species occur in it.

Amblystegium Kochii, which hitherto has only been known as occurring in Britain in a single locality in Sussex, where it was found by Mitten, occurs at Kew in one or two places by the Thames, together with *A. varium*, *Fissidens crassipes*, *Physcomitrium pyriforme*, *Leskea polycarpa*, *Cinclidotus fontinaloides*, etc.

Of other interesting species, *Mnium cuspidatum*, *M. stellare*, *Bryum Donii*, *Tortula intermedia*, *Trichostomum tortuosum*, *Encalypta streptocarpa*, *Barbula lurida*, and *Neckera crispa* have been noticed only in or about the Rockery; and, for reasons mentioned above, their nativity must remain doubtful.

On the other hand, the following species (amongst others) are certainly wild:—*Polytrichum formosum*, *Plagiothecium borrerianum*, *Pleuridium axillare*, *P. subulatum*, *P. alternifolium*, *Funaria fascicularis*, *Tortula marginata*, *Fissidens pusillus*, *F. exilis*, *F. incurvus*, *F. viridulus*, *Leptobryum pyriforme*, *Acaulon muticum* and var. *mediterraneum*, *Bartramia pomiformis*, *Ephemerum serratum*, *Aulacomnium androgynum*, *Dicranum Bonjeani*, *Thamnium alopecurum*, *Eurhynchium piliferum*, and *E. megapolitanum*.

I have to thank Mr. George Massee for a list, accompanied by specimens, of 20 Kew mosses, collected by him in previous years. Five of them, which I have not been able to refind, are included in the list on his authority. In most cases the habitats of these species have become changed through improvements, and the species are very probably now lost.

To Mr. George Nicholson I am greatly indebted, not only for furnishing me with a list of about 40 mosses already recorded for Kew Gardens, but also for showing me the original stations for many of these, and for helping me to search for new species.

The nomenclature followed is that of Dixon's "Students' Handbook of British Mosses."

I have placed specimens of the more interesting species in the Kew Herbarium.

Explanation of the abbreviations used :—

A. Arboretum.
B. Botanic Garden.
P. Palace and Herbarium Grounds.
Q. Queen's Cottage Grounds.
R. Rockery.

Catharinea undulata, *Web. et Mohr.*
Common, and fruiting freely in all the drier places, as in the Rockery, where it forms luxuriant patches.

Polytrichum aloides, *Hedw.*
In several places along the boundary ditch by the Old Deer Park, between the Lion Gate and Queen's Cottage ; fruit not seen.

P. piliferum, *Schreb.*
Not uncommon in dry places ; abundant along the boundary ditch with the last species ; sandy banks near the lake, etc. ; occasionally fruiting.

P. juniperinum, *Willd.*
Abundant in dry places throughout the Gardens ; frequently fruiting.

P. formosum, *Hedw.*
Fairly common in sandy places, in the open, and also under trees ; fruiting in the Arboretum.

A curious *Polytrichum*, intermediate in some characters between *P. formosum* and *P. gracile*, Dicks, occurs in a few places along the boundary ditch by the Old Deer Park. In this form the leaf-base, instead of being composed of cells about 6–10 times as long as broad, as is usual in *P. formosum* (see Dixon, *Student's Handbook*, p. 46), shows an areolation similar to that of *P. gracile*, the cells being comparatively wide, and only 3–4 times as long as broad. Occasionally, also, the plant shows a further approach towards *gracile*, as some of the leaves have a rather wide limb in the upper part of the leaf, and frequently the lamellæ are only about 40 in number.

Both Mr. W. E. Nicholson and Mr. Dixon at first referred the plant to *P. gracile*, Dicks, relying especially on the short wide basal areolation. I have just heard from Mr. Dixon, however, that Mr. Bagnall, to whom specimens of the Kew plant were submitted, thinks that it should be referred to *P. formosum*, and that Mr. Dixon himself is now inclined to agree with the view that it is nearer that species than *P. gracile*, although still thinking that there is an approach to the form of areolation of the latter. Only barren plants of this form, which is certainly native, have so far been found.

Pleuridium axillare, *Lindb.* (c. fr.)
In the Bamboo Garden and near the Pumping Station. Occurs commonly in pots in the Glass-houses, where the leaf cells become very lax.

P. subulatum, *Rabenh.* (c. fr.).
Not uncommon on sandy ground ; about the lake and on the islands ; Bamboo Garden ; Tulip Tree Avenue ; P.

P. alternifolium, *Rabenh.* (c. fr.).
A., bare places near the lake ; Rose Garden, on earth adhering to stumps.

Ceratodon purpureus, *Brid.*
Abundant and common in fruit throughout the area.

Dicranella heteromalla, *Schimp.*
Abundant and fruiting in all the drier places.

D. cerviculata, *Schimp.* (c. fr.).
Kew Gardens (unlocalised, Massee, 1897).

D. varia, *Schimp.*
On mud thrown up from a ditch, near Pumping Station, in fruit (Massee, 1897).

Dicranum Bonjeani, *De Not.*
Q. Abundant in one place, barren ; A. pinetum ; B. small form, growing on a bank, with a very different habit from the type, is referred to this species by Mr. Dixon with the following note :— "I think your *Dicranum* must be *Bonjeani* from the general 'tone' and areolation and thin nerve without ridges at the back, as well as the undulation, which is indeed very faint (the leaves being so short), but is distinguishable on most leaves, I think, or many, at least. It is a very short-leaved form."

D. scoparium, *Hedw.*
Common in dry places under trees, amongst grass, etc. ; barren.

Fissidens exilis, *Hedw.* (c. fr.).
A., on the third island (from culvert end) in the lake ; Q., in an open space.

F. viridulus, *Wahlenb.* (c. fr.).
Q., on a loose stone ; boundary ditch near the river ; A., on stones embedded in the bank near the other (Lion Gate) end of the boundary ditch.

Var. Lylei, *Wils.*
Some of the plants from the first locality given above have leaves which, by being unbordered, except on the vaginant-laminæ, must be referred to this variety.

F. pusillus, *Wils.* (c. fr.).
P., on brick steps ; R., on stones. Abundant on the sandstone rocks in the Winter Garden.

F. incurvus, *Starke* (c. fr.)
Q., side of the boundary ditch.

F. bryoides, *Hedw.*
Very common ; fruiting both in wet places, such as the banks of the lake, and on dry sandy banks.

F. crassipes, *Wils.* (c. fr.).
By the riverside, on wood ; often submerged at high tide ; B., on mortar, wall of tank in Herbaceous Ground (Massee, 1897). One of the most interesting of the Kew mosses, and occurring in fair quantity in the first-mentioned locality. The thick seta easily distinguishes this species in the field.

F. taxifolius, *Hedw.*
Not uncommon in damp places ; about the lake ; river-side ; Palace Grounds ; not found in fruit.

Grimmia pulvinata, *Sm.* (c. fr.).
R., on stones ; P., on the wall by the river.

Acaulon muticum, *C. Müll.* (c. fr.)
On third island (from Culvert end) in the lake, on stiff clay ; and (*A. mediterraneum*, Braithw.) A., sandy ground near the west end of the lake ; P., sandy bank (Nicholson).

I do not think that the plant described by Braithwaite under the name of "*Acaulon mediterraneum*, Limpr.," in the British Moss Flora, i, p. 301, deserves to rank higher than a variety of *A. muticum.*

On a sandy bank near Bexhill, Sussex, I have collected an *Acaulon*, in which the long inner bract is completely wrapped round the fruit, and the plants are tall, and sometimes slightly curved,—in fact, agreeing well with *A. mediterraneum* as described in the British Moss Flora, (loc. cit.). Dr. Braithwaite agreed with me in referring the plant to that species. Of the Kew specimens of *Acaulon*, those from the damp ground of the island in the lake have connivent subequal bracts, and capsules scarcely, or not at all apiculate, those from the sandy ground have unequal bracts, with the inner longer one more or less convolute, and the capsule minutely apiculate. I have, however, seen so many plants, from other localities, presenting exactly intermediate characters, that I am strongly of opinion that "*A mediterraneum*" is not specifically distinct from *A. muticum*, but is to be regarded as a variety of the latter, produced (in my experience) in dry sandy localities. It may also be pointed out that Dr. Braithwaite's description of "*A mediterraneum*, Limpr.," does not agree at all well with Limpricht's original diagnosis. (*Rabenh. Krypt. Fl. Deutschland*, iv. (1885) p. 180). Dr. Braithwaite emphasizes the convolute bract, and describes the plant as taller than *A. muticum* ; Limpricht says that his species is smaller than *A. muticum*, with leaves smaller, not (or scarcely) connivent, and capsule visible from above, and does not mention the convolute inner bract, nor the apiculate capsule. *A. mediterraneum*, as described by Limpricht, seems altogether nearer to *A. muticum*, var. *minus*, than to the plant described and figured by Dr. Braithwaite as Limpricht's species.

Phascum cuspidatum, *Schreb.* (c. fr.).
Frequent in bare places among the grass ; on paths, &c.

Var. **schreberianum,** *Brid.*
Bare places among the gorse, west end of the lake.

Pottia truncatula, *Lindb.* (c. fr.).
Not common. P., Nurseries, &c.

Tortula ambigua, *Angstr.* (c. fr.).
R. (Massee, 1897).

T. marginata, *Spruce.* (c. fr.).
R., abundant on stones ; P., brick steps. Certainly indigenous.

T. muralis, *Hedw.* (c. fr.).
Abundant everywhere, on walls and stones.

Var. **æstiva**, *Brid.*
Fernery, one or two tufts of a well-marked state of this variety.

T. intermedia, *Berk.*
R. Several tufts. here and there, on the stones, barren ; also in fruit (Massee, 1897).

Barbula rubella, *Mitt.* (c. fr.).
R. Common.

B. fallax, *Hedw.*
Not uncommon ; riverside and gardens, occasionally fruiting.

B. hornschuchiana, *Schultz.*
Among the grass, near the lake, barren.

B. revoluta, *Brid.*
R. In several places, barren ; also in fruit (Massee, 1897).

B. unguiculata, *Hedw.*
Common throughout the gardens, rarely fruiting.

B. lurida, *Lindb.*
R. Sparingly, and barren.

B. vinealis, *Brid.*
R. In several places, barren.

Weisia squarrosa, *C. Müll.* (c. fr.).
On mud thrown up from a ditch, near pumping station, in fruit (Massee, 1897).

W. viridula, *Hedw.* (c. fr.).
Q., common along the boundary ditch.

Trichostomum tortuosum, *Dixon.*
R. Very sparingly and barren, on stones.

Cinclidotus fontinaloides, *P. Beauv.*
Not uncommon by the river, fruiting occasionally.

Encalypta streptocarpa, *Hedw.*
R. On stones, barren.

Orthotrichum anomalum, *Hedw.* var. **saxatile**, *Milde.* (c. fr.).
R., a few tufts ; on a wall, by the river-side.

O. affine, *Schrad.* (c. fr.).
By the river-side, very sparingly, on a stone wall.

O. diaphanum, *Schrad.* (c. fr.).
Wall, by the river, sparingly.

Ephemerum serratum, *Hampe* (c. fr.).
On a bank near the south end of the lake.

Physcomitrium pyriforme, *Brid.*
Patches of fruiting plants here and there by the river-side.

Funaria fascicularis, *Schimp.*
P. A few fruiting plants, on a sandy bank, with *Bartramia pomiformis*, certainly native. A. Mr. G. Nicholson and Mr. E. M. Holmes have gathered it near the flagstaff, but it has now disappeared from this locality.

F. hygrometrica, *Sibth.* (c. fr.).
Abundant everywhere—in the driest places, as on cinders, as well as by the river-side, where it is often submerged.

Aulacomnium androgynum, *Schwaeg.*
Q. Gemmiferous state; on elder tree. A. On a tree near the flagstaff.

Bartramia pomiformis, *Hedw.*
Q., quite wild; boundary ditch; P. In both places with a few capsules.

Leptobryum pyriforme, *Wils.*
R. Not uncommon; fruiting on stones. P. On ground, among grass. Occurs commonly in pots in the glass-houses, forcing-pits, &c.

Webera nutans, *Hedw.* (c. fr.).
Common. Q., on stumps; A., Bamboo garden, &c.

W. carnea, *Schimp.*
Barren; bamboo garden; river-side.

Bryum inclinatum, *Bland.*
R., in fruit; A., Rose garden.

B. pallens, *Sw.*
R., on a wet bank; a dark-green form with numerous proto-nematoid branches.

Mr. Dixon reported on it: "I believe your *Bryum* is a form of *B. pallens*. It has the peculiar areolation of that which is somewhat hard to define, decurrent leaves, etc. The var. *speciosum* is something like it, but not quite the same. The tips of the branches show a little of the characteristic vinous red of *pallens*. The gemmiform threads I should take to be an *abnormal* outgrowth such as one finds in mosses growing in unusually damp situations."

B. pseudo-triquetrum, *Schwaeg.*
By the river-side; A., near rose garden. Barren.

B. cæspiticium, *Linn.* (c. fr.).
Not uncommon. R., &c.

B. intermedium, *Brid.* (c. fr.).
Q., in an open spot.

B. capillare, *Linn.*
R., abundant, fruiting; Q., boundary ditch, &c.

B. donianum, *Grev.*
R. One tuft, with a few capsules.

B. erythrocarpum, *Schwaeg.*
Not uncommon, often among grass. Bamboo garden, P., &c.

B. atropurpureum, *Web. et Mohr* (c. fr.).
A., on stumps near lake.

B. argenteum, *Linn.*
On paths, roofs, stones, &c. ; occasionally fruiting.

Var. **lanatum**, *Bruch et Schimp.*
Commoner than the type in the area ; occurring in dry places, especially on walls exposed to the sun. All authors, without exception, as far as I can find, describe the nerve of the leaf of *B. argenteum* as ceasing below the apex, and it does not seem to have been noticed that in the var. *lanatum* the nerve is distinctly excurrent. Most authors describe only the shape of the leaf as characteristic of the var. *lanatum*, without referring to the nerve ; Husnot (*Musc. Gall.* i., 243), however, describes and figures the nerve as very short. In the Kew plant, as mentioned above, as well as in all other examples of the var. *lanatum* that I have seen, the nerve is distinctly excurrent, and I believe that this structure is characteristic of the variety.

Mnium affine, *Bland.*
Amongst grass. P.

M. cuspidatum, *Hedw.* (non *Neck.*).
R. Occasionally producing a few capsules ; originally found by Mr. G. Nicholson.

M. rostratum, *Schrad.*
Not uncommon in dry places among the grass ; fruiting in the Queen's Cottage Grounds (Massee, 1897).

M. undulatum, *Linn.*
Q. ; P. Sparingly.

M. hornum, *Linn.* (c. fr.).
Common ; very fine in Q., P., &c.

M. stellare, *Reichb.*
In one place in the Rockery.

Fontinalis antipyretica, *Linn.*
In the moat by the river.

Neckera crispa, *Hedw.*
R. Very sparingly, and starved.

Porotrichum alopecurum, *Mitt.*
Q. ; also occurs in the Winter Garden.

Leskea polycarpa, *Ehrh.*
By the river-side ; frequent on wood ; occasionally on the stone wall ; often fruiting. Probably the same station as that indicated in De Crespigny's "New London Flora," p. 90 (1877).

Thuidium tamariscinum, *Bruch et Schimp.*
P. ; Q. ; A., fine and plentiful, on banks near the bamboo garden.

T. recognitum, *Lindb.*
Among grass, P. (Massee, 1898.)

Pleuropus sericeus, *Dixon.*
Frequent on stones and walls ; R., river-side, &c. ; not noticed in fruit.

Brachythecium albicans, *Bruch et Schimp.*
Bank by the North Gallery ; among grass about the lake ; river-side, between the west boundary and Isleworth Gate.

B. rutabulum, *Bruch et Schimp.*
Common and fruiting freely.

B. velutinum, *Bruch et Schimp.* (c. fr).
Rather common ; islands in the lake ; Q., boundary ditch ; P., &c. Plants from the Palace grounds have long setæ, and drawn out stems, and agree with the var. *prælongum* of the Bryologia Europæa, which cannot, however, be considered more than a form.

B. populeum, *Bruch et Schimp.*
Fernery (fruiting) ; R. ; wall by river.

B. purum, *Dixon.*
Common among the grass, &c.

Eurhynchium piliferum, *Bruch et Schimp.*
P., in one place ; native.

E. prælongum, *Bruch et Schimp.*
Abundant everywhere ; occasionally fruiting. Also occurs fruiting in some of the Houses, e.g., Winter Garden.

E. Swartzii, *Hobkirk.*
On the ground, river-side ; P. ; Q., boundary ditch, also a very pretty form, more closely branched than usual, on stones near the Cumberland Gate ; Winter Garden.

E. pumilum, *Schimp.*
P. ; also occurs plentifully on stones in the Winter Garden.

E. tenellum, *Milde.*
R., barren. Fruiting on Tree-Fern stems in the Winter Garden ; these plants have quite smooth setæ, so that they cannot be referred to the var. *scabrellum*, Dixon, which is the usual form found on tree trunks, stumps, twigs, &c. Mr. W. E. Nicholson informs me, however, that he has met with the type occasionally on trees, in Sussex.

E. rusciforme, *Milde.*
Abundant, and fruiting freely, by the river.

E. murale, *Milde.*
Not uncommon on stones ; R., &c., fruiting freely.

E. confertum, *Milde.*
Abundant in fruit. P. ; wall by the river ; R., &c.

E. megapolitanum, *Milde.*
P., among the grass, on sand, fruiting. Certainly native. Mr. W. E. Nicholson tells me that the Kew plant agrees well with examples collected by him on sandy banks in West Sussex.

Plagiothecium borrerianum, *Spruce.*
Frequent, often forming large patches on sandy banks, as about the Bamboo Garden.

P. denticulatum, *Bruch et Schimp.*
Frequent; R., P., &c. Occasionally fruiting.

P. sylvaticum, *Bruch et Schimp.* (c. fr.).
Q.; P. Sparingly.

Amblystegium serpens, *Bruch et Schimp.* (c. fr.).
Abundant everywhere.

A. varium, *Lindb.*
In a few places by the river.

A. filicinum, *De Not.*
R. Common; on wall by river-side.

A. Kochii, *Bruch et Schimp.*
In one or two spots by the river. Hitherto only known in Britain from Hurstpierpoint, Sussex.

Hypnum riparium, *Linn.* (c. fr.).
About the lake, on the islands; all along the river-side.

H. elodes, *Spruce.*
On an old stump, near the Cumberland Gate, in fruit (Massee, 1897). A very interesting record. Unfortunately the species cannot be refound, and it is probable that it has disappeared from the original locality through the formation of a rockery.

H. stellatum, *Schreb.*
R., very sparingly.

H. cupressiforme, *Linn.*
Abundant.

Var. **resupinatum**, *Schimp.*
R.; boundary ditch; P., &c., not uncommon.

Var. **filiforme**, *Brid.*
On trees. Q.; A.

H. molluscum, *Hedw.*
R., in a few places.

H. palustre, *Linn.*
Here and there by the river-side. A curious form, growing on wood more or less submerged at high tide, is thus reported on by Mr. Dixon: "I take your moss to be a curious form of *H. palustre*; a single-nerved form, but nerve sometimes very feeble. The leaf-apex is characteristic, and on some of the stems the leaves have the secund position usual in the species."

H. cuspidatum, *Linn.*
P.; R.; among the grass in many places.

H. Schreberi, *Willd.*
Abundant in the Pinetum, near the Water-Lily Pond.

Hylocomium squarrosum, *Bruch et Schimp.*
Very common among the grass under trees.

APPENDIX.

The following species have occurred in the glass-houses only :—

Physcomitrium eurystomum, *Sendt.* (c. fr.).
On earth, in a pot, No. 2 House (Nicholson).

Aulacomnium palustre, *Schwaeg.*
Common in several of the Houses, especially the Filmy-Fern House, in the gemmiferous state. First noticed here by Professor Bower, see Journ. Linn. Soc. (Bot.), xx. (1884), p. 465, where an account of the structure and germination of the gemmæ is given. The pseudopodia are sometimes quite leafless, just as in *A. androgynum*.

Fissidens Nicholsonii, *Salmon.*
Mr. Nicholson discovered this *Fissidens* growing in one of the Houses, on a Tree-Fern stem, brought from Jamaica. It proved on examination to be a new species allied to *F. Ravenelii*, Sulliv., and is to be described and figured as *F. Nicholsonii* in the *Annals of Botany*.

Hypopterygium viridulum, *Mitt.*
Trunks of Tree-Ferns, Winter Garden.

Rhizogonium pennatum, *Hook f. et Wils.*
Common in the Filmy-Fern House.

Cyathophorum pennatum, *Brid.*
At the base of Tree-Fern stems, Winter Garden.

ERNEST S. SALMON.

DCXXXVIII.—MISCELLANEOUS NOTES.

Retirement of Mr. J. G. Baker.—The termination of the official services of this well-known member of the Kew staff on reaching the age limit on January 12th of the present year, cannot be passed over without a brief record. Mr. John Gilbert Baker, having already acquired a reputation as a critical botanist, entered the Herbarium and Library of the Royal Botanic Gardens in 1866 as Assistant. He became successively a Principal Assistant in 1884, and Keeper in 1890. Gifted with exceptional powers of sustained work, he devoted unflagging energy to his laborious official duties. He became the acknowledged authority on the nomenclature and classification of Ferns and of Petaloid Monocotyledons. His non-official hours were no

less profitably employed. The following list comprises the more important works which he turned out with untiring industry in the time which was at his own disposal :—

1863.—North Yorkshire ; Studies of its Botany, Climate, and Physical Geography.
1866.—Flora of Northumberland and Durham.
1868.—Synopsis Filicum (with Sir W. J. Hooker). 2nd edition, 1874.
1869.—Synopsis of Narcissus.
1869–1873.—Refugium Botanicum (4 vols.).
1870–1879.—Monograph of Liliaceæ (Journal of Linnean Society.)
1871.—Monograph of British Roses.
1870–1884.—Ferns and Compositæ of Brazil.
1871.—Leguminosæ of Tropical Africa.
1873.—Synopsis of Crocus.
1875–1898.—Contributions to Botanical Magazine.
1875.—Elementary Lessons in Botanical Geography.
1876.—Systema Iridacearum.
1877.—Flora of Mauritius and Seychelles.
Synopsis of Agave.
1878.—Welwitsch's Petaloid Monocotyledons of Angola.
1879.—Leguminosæ of British India.
1879–1890.—Descriptions of New Plants from Madagascar (1,200 species).
1880.—Monograph of Isoetes.
1882.—Watson's Topographical Botany. 2nd edition.
Synopsis of Selaginella.
1884–5.—Presidential Address to Yorkshire Naturalists' Union.
1885.—Flora of English Lake District.
1886.—Hooker's Icones Plantarum, Vol. XVII. (Ferns).
Handbook of Fern Allies.
1887.—Handbook of Amaryllideæ.
1889.—Handbook of Bromeliaceæ.
1892.—Handbook of Irideæ.
Scitamineæ of British India.
1896–7.—Flora Capensis, Vol. VI. (Petaloid Monocotyledons).
1898.—Petaloid Monocotyledons of Tropical Africa.

The production of this immense amount of technical work of acknowledged merit not merely added lustre to the establishment, but was of immense value to it. Under these circumstances an application was made to the Treasury for a special grant in excess of the prescribed rate of pension. This, however, my Lords, while "fully aware of the good service rendered by Mr. Baker," declined to give. Mr. Baker was elected a Fellow of the Royal Society in 1878.

Keeper of the Herbarium and Library.—The appointment of Mr. William Botting Hemsley, F.R.S., a Principal Assistant in the Herbarium and Library of the Royal Botanic Gardens, to the post of Keeper in succession to Mr. J. G. Baker, retired, was

approved by the First Commissioner of Her Majesty's Works and Public Buildings. Mr. Hemsley took up his duties on 13th January of the present year.

Principal Assistant (Phanerogams). — The appointment of Dr. Otto Stapf, Assistant for India since 1891, as Principal Assistant in succession to Mr. Hemsley, promoted, was approved by the First Commissioner. Dr. Stapf took up his duties on January 13th of the present year.

Mr. William Leslie, a member of the gardening staff of the Royal Gardens, has been appointed, on the recommendation of Kew, by the Secretary of State for the Colonies, Assistant Superintendent of the Royal Botanic Gardens, Trinidad, in succession to Mr. William Lunt, appointed Curator, Botanic Station, St. Kitts.

Visitors during 1898.—The number of persons who visited the Royal Botanic Gardens during the year 1898 was 1,277,215. That for 1897 was 1,239,683. The average for 1888–97 was 1,444,716. The total number on Sundays was 484,054, and on week-days 793,161. The maximum number on any one day was 71,871 on May 30, and the smallest 67 on November 21.

It is remarkable that while the total number fluctuates within comparatively narrow limits, the aggregate attendance on week-days increases, while that on Sundays diminishes. In 1891 they nearly balanced.

The detailed monthly returns are given below :—

January	20,643
February	19,995
March	33,844
April	182,494
May	181,551
June	169,003
July	212,338
August	251,971
September	124,059
October	39,206
November	23,787
December	18,324

Mrs. Barnard.—This lady, the wife of Major R. Cary Barnard, F.L.S., of Cheltenham, the daughter of the late Professor J. S. Henslow, and sister-in-law of Sir Joseph Hooker, died on January 19th. Inheriting in no small degree her father's taste for botany, she was a very good botanical artist, and contributed a considerable number of plates to the *Botanical Magazine* between

the years 1879 and 1886. She also made the drawings for the wood-cuts which illustrate Professor Oliver's *Lessons in Elementary Botany*, a well-known and popular introduction to systematic botany, in part based upon materials left in manuscript by Professor Henslow himself.

Botanical Magazine for December.—The present number completes the 124th volume, which is dedicated to Mr W. B. Hemsley, F.R.S., at the date of publication Principal Assistant in the Herbarium of the Royal Gardens. All the five plants figured are in cultivation at Kew. *Musa Bakeri* is a new species, supposed to be a native of Cochin China. It was obtained from the Jardin des Plantes, Paris. The Kew plant, which has a stem 10 feet high, flowered for the first time in October, 1895. *Cardamine latifolia*, from the Pyrenees and Southern Italy, is a robust plant with rather large, rosy-lilac flowers. *Paphiopedilum mastersianum*, native of Java, was sent to Kew by Messrs. Sander & Co., of St. Albans. It is an unusually handsome species both in leaves and flowers. *Caladenia carnea*, var. *alba*, a terrestrial orchid from Eastern Australia and Tasmania, was received from Mr. J. O'Brien, of Harrow-on-the-Hill. The disk of the recurved lip is furnished with two or more rows of stalked, capitate glands, *Fritillaria pluriflora*, a decidedly ornamental species from Northern California, whence bulbs were sent to Kew by Mr. Carl Purdy, of Ukiah, has rose-coloured flowers an inch long, and about two inches wide, arranged in a loose raceme.

Botanical Magazine for January.—*Acalypha hispida* (A. Sanderi), is the handsome subject of the first plate of the new volume. Though so recently introduced into European gardens, its merit as a highly ornamental plant for stove cultivation has become well established. The specimen figured was received from Messrs. Sander, of St. Albans, plants having been sent to them by their collector from the Bismarck Archipelago, in 1896. *Lewisia Tweedyi* is a native of the Wenatchee mountains, in Washington State, U.S.A. It is a stemless, somewhat succulent plant, with flowers three inches in diameter: the petals are straw-coloured, becoming bright pink at the tips and edges. The Kew plant was acquired by purchase. The very pretty *Lilium rubellum* was first described early last year from material received from Messrs. Bunting, of Chelmsford. It is a native of Japan, and allied to *L. japonicum*, but the flowers are smaller and pink. *Gaultheria trichophylla* is a diminutive species from the Himalaya and Western China. The Kew plants were received from the Hon. Charles Ellis, of Frensham Hall, Haslemere. *Meconopsis heterophylla*, from California, is the only American species of the genus. The plant figured was raised from seed received from a Californian nurseryman.

Kirk's Student's Flora of New Zealand.—The death of Professor T. Kirk, of New Zealand, was announced in the *Kew Bulletin* (1898, p. 57), where, also, reference was made to his unfinished work bearing the above title. Since then Sir James Hector, Director of the Geological Survey of New Zealand, and of the New Zealand Institute, has sent Sir Joseph Hooker "clean sheets" of the work, so far as it has been printed off; and they have been presented by him to Kew. It is gratifying to learn from the same source that this fragment will be published, and that another botanist will probably be commissioned to write a *Flora* of the country on a less comprehensive plan. Kirk's *Flora* is, as far as completed, admirable in method, and, as far as possible, exhaustive in treatment. It is a matter of deep regret that the author did not live to complete it, as it can hardly be hoped that any other botanist will be found to take up the unfinished task with Kirk's local, botanical, and literary skill. But what is more imperatively required, in the first place, is a handy and cheap book, in which the plants are described in familiar language, without any attempt on the part of the author to reach finality; that is to say, to discriminate critical forms, or to wait for complete specimens of rare species in order to be able to fully describe them.

The fragment of Kirk's *Flora* comprises the orders Ranunculaceæ to Compositæ, covering 363 large octavo pages; or, more space than the whole of the flowering plants and ferns occupy in Hooker's *Handbook*. It is true that the author includes numerous introduced plants; but many of these are so abundant and so widely spread that they form an important, or at least a conspicuous part of the vegetation in certain districts. Some, indeed, pervade the whole country, and it is as necessary for the student to have means of identifying them as the rarer aboriginal plants. To the beginner they are as much natives as the others. In Kirk's work the names and descriptions of the introduced plants are printed in different type from the rest.

The Ferns of North-Western India.—Mr. C. W. Hope, late of the Public Works Department, Government of India, who devoted much of his leisure time while in India to the study of ferns, has, since his retirement, continued his studies at Kew, and is on the eve of publishing a detailed account of all the species inhabiting the North-Western Provinces and adjoining territories. This partially descriptive enumeration will shortly appear in the *Journal* of the Bombay Natural History Society, and will be illustrated by a number of plates.

Para Rubber in Penang.—A brief reference to the experimental production of this rubber was given in the *Kew Bulletin* for 1898, p. 273. Two samples have since been received from Mr. C. Curtis, the Assistant Superintendent of Forests, both of which were

taken from a tree growing in the Botanic Garden, the quantity collected amounting to three pounds. One sample had been coagulated with, and the other without, alum, but both were dried by fire heat. Accompanying the samples was a bag of chips or shavings of the wood of the rubber tree, containing a quantity of the coagulated juice; it was thought that they might prove a marketable article for the extraction of the rubber. All the samples were submitted to Messrs. Hecht, Levis, and Kahn, the well-known rubber brokers of Mincing Lane, who kindly furnished the following report under date February 3rd, 1899:—"The rubber shavings are almost valueless, containing as they do only small traces of rubber. We estimate the value of these shavings from 4*d*. to 5*d*. per pound. The other two samples are of excellent quality, and would meet with a ready sale at probably about 3*s*. 6*d*. per pound, if the bulk of the rubber is equal in dryness to the two small cakes you have sent us. The treatment of No. 1 with alum does not in any way interfere with the quality."

Para Rubber in Perak.—The experimental cultivation of Para Rubber in the Straits Settlements has been discussed in the *Kew Bulletin*, 1898, pp. 271–274.

The following report gives a higher valuation for the produce of the trees grown in Perak than that already quoted.

THE SUPERINTENDENT, GOVERNMENT PLANTATIONS, PERAK, to THE SECRETARY TO GOVERNMENT, PERAK.

Government Plantations Office,
Taiping, October 3, 1898.

SIR,

I have the honour to forward herewith a copy of the correspondence in connection with a parcel of Para Rubber (208 pounds sheet, and 8 pounds scrap), prepared at Kuala Kangsar, and sent home for sale.

The correspondence is interesting, as it shows market value of Para Rubber grown in Malaya. The parcel realised $293.90, exclusive of charges.

The Rubber was valued at about 3*s*. 5*d*. per pound, but sold for 3*s*. 1*d*., owing to the cost of analysis.

The analysis showed a loss of 26½ per cent. in washing, but the manufacturers think that if sent home in bulk, the loss would be 30 per cent., as a large quantity could not be sent home so dry.

I have, &c.,
(Signed) R. DERRY,
Superintendent of Government Plantations.

Mauritius Tea.—The cultivation of tea in Mauritius, has been discussed in the *Kew Bulletin* for February, 1887, p. 7: and 1892,

pp. 234–238. The following is the most recent information with regard to it :—

EXTRACT from the Annual Report on Mauritius and Rodrigues for 1897, p. 27.

The cultivation of tea has been extended, and produce of excellent quality has been put on the market in limited supplies. While the quality is sufficiently good to enable it to compete on the English market, the scale on which it has been produced has not been sufficiently large to show whether the cost of manufacture will permit of exporting it profitably.

Coffee-leaf Disease in Zanzibar.—The occurrence of this fungus-parasite in German East Africa was recorded in the *Kew Bulletin* for 1894 (p. 412). According to *The Shamba: Journal of Agriculture for Zanzibar*, September, 1898, it has now made its appearance in Zanzibar. The statement, though not improbable, has not been verified, as far as is known, by a scientific examination :—

" Some of the Liberian coffee trees at Mbweni bear the unmistakable stamp of the well-known coffee-leaf disease (*Hemileia vastatrix*). The disease is a fungus which first attacks the under side of the leaves causing spots or blotches at first yellow but subsequently turning black. These blotches are, on examination, found to be covered with a pale, orange-coloured dust or powder which easily rubs off. The blotches gradually increase in size till at last they have spread over the leaves, which then drop off, leaving the trees in a short time quite bare, in which state they are of course unable to produce crop or bring that which may have already been produced to maturity. Its ravages in Ceylon in the eighties converted hundreds of acres of beautiful Arabian coffee into withered sticks, as if a fire had raged through the fields. The whole of the Eastern world was more or less infected from Ceylon, but as far as we know this is the first actual appearance of the disease in Zanzibar. The Liberian species is not supposed to be subject to its attacks, and this makes its appearance at Mbweni all the more interesting. Otherwise the trees there show a most robust and healthy growth in spite of dry weather."

Fungus-gamboge.—Zopf gives this name (*Bot. Ztg.*, 1889, p. 53), to a yellow substance obtained from *Polyporus hispidus*, Fries, which corresponds in all its characters to gamboge-yellow, the chief constituent of gamboge. It is insoluble in water, but readily soluble in ether and alcohol ; it is dissolved with the formation of a red colour in concentrated nitric or sulphuric acid, and precipitated as yellow scales from these solutions on the addition of water. The colouring matter is abundant in the cell-walls, cell-contents, and also as an excretion on the surface of the hymenium. *Polyporus hispidus* is a common fungus, and could be obtained in quantity, should fungus-gamboge prove to possess any economic value.

Professor Hummel, of the Dyeing School, Leeds, was kind enough to examine the colouring matter, and furnished the following report :—

PROF. HUMMEL TO ROYAL GARDENS, KEW.

Clothworkers' Departments,
The Yorkshire College, Leeds,
November, 1897.

DEAR SIR,

HEREWITH enclosed I send you two pieces of calico mordanted with iron and aluminium in a stripe pattern, and dyed with (*a*) Old Fustic (*Morus tinctoria*), (*b*) *Polyporus hispidus*, received from you.

The experiment shows that *P. hispidus* contains a yellow mordant-colouring-matter in moderate quantity, but the colours obtained are not bright enough, nor is the fungus sufficiently rich in colouring matter to render it of commercial value in Europe.

If you will be good enough to procure about 10 lbs. weight of the fungus, it will be worth while making a chemical examination to determine what the colouring matter is.

Yours truly,
(Signed) J. J. HUMMEL.

W. T. Thiselton-Dyer, Esq., F.R.S.,
Director, Royal Gardens, Kew.

Agaricus (Armillaria) melleus, Vahl.

Wyman & Sons, Ltd., Lith. 3576. 1.99.